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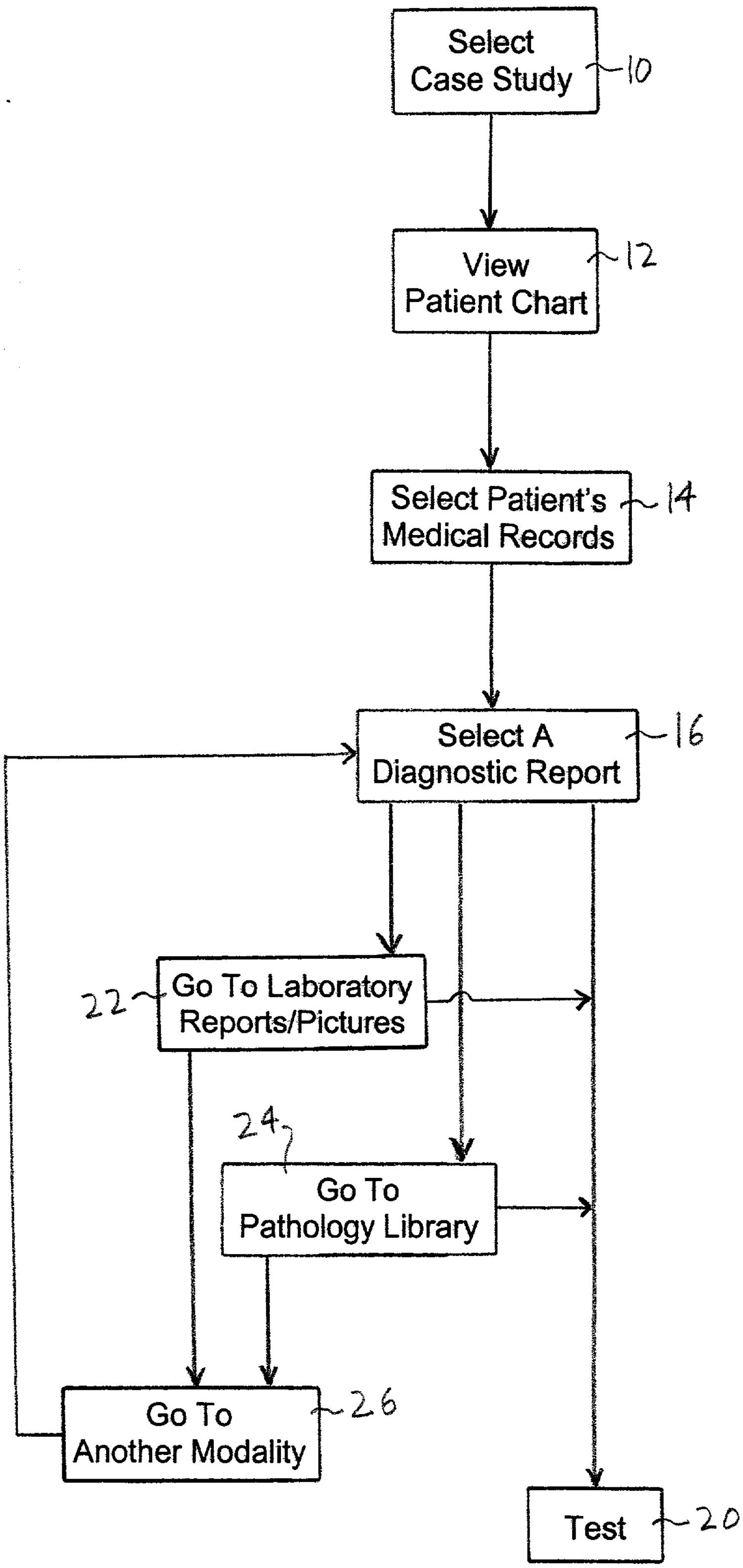

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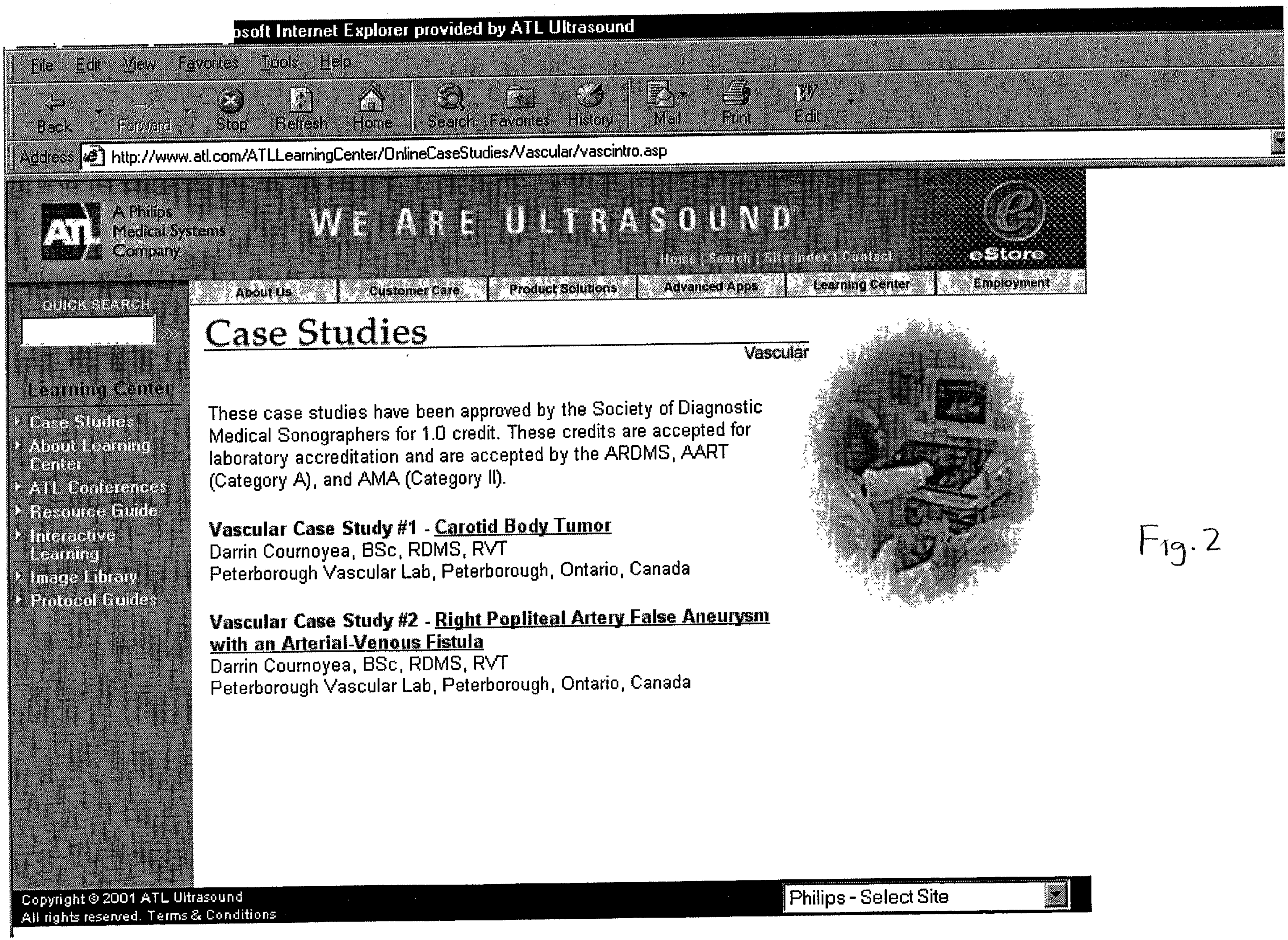
Fig.1



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These case studies have been approved by the Society of Diagnostic Medical Sonographers for 1.0 credit. These credits are accepted for laboratory accreditation and are accepted by the ARDMS, AART (Category A), and AMA (Category II).
Vascular Case Study #1 - Carotid Body Tumor
Darrin Cournoyea, BSc, RDMS, RVT
Peterborough Vascular Lab, Peterborough, Ontario, Canada
Vascular Case Study #2 - Right Popliteal Artery False Aneurysm with an Arterial-Venous Fistula
Darrin Cournoyea, BSc, RDMS, RVT
Peterborough Vascular Lab, Peterborough, Ontario, Canada
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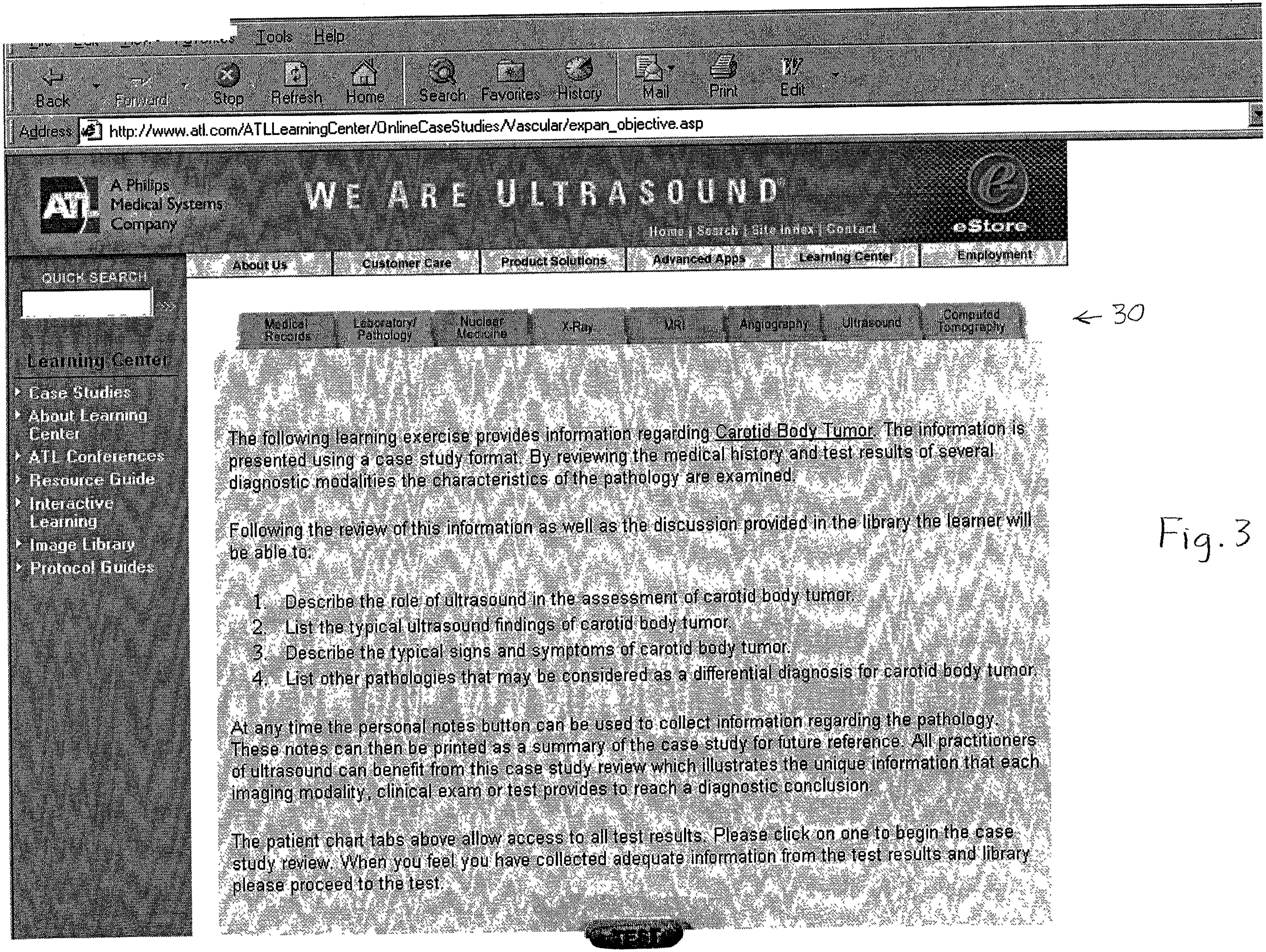
Fig. 2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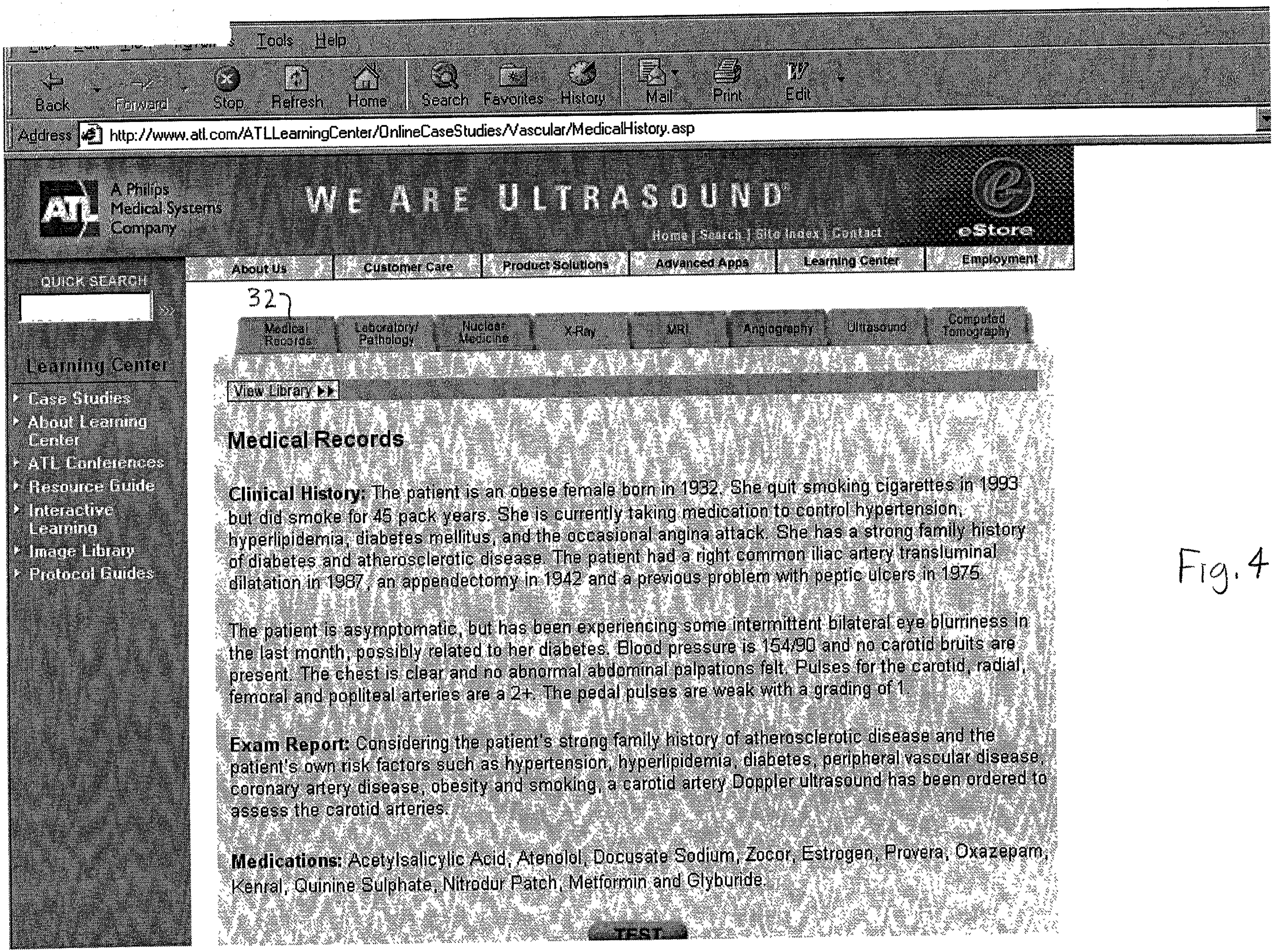
The following learning exercise provides information regarding Carotid Body Tumor. The information is presented using a case study format. By reviewing the medical history and test results of several diagnostic modalities the characteristics of the pathology are examined.
Following the review of this information as well as the discussion provided in the library the learner will be able to:
1. Describe the role of ultrasound in the assessment of carotid body tumor.
2. List the typical ultrasound findings of carotid body tumor.
3. Describe the typical signs and symptoms of carotid body tumor.
4. List other pathologies that may be considered as a differential diagnosis for carotid body tumor.
At any time the personal notes button can be used to collect information regarding the pathology. These notes can then be printed as a summary of the case study for future reference. All practitioners of ultrasound can benefit from this case study review which illustrates the unique information that each imaging modality, clinical exam or test provides to reach a diagnostic conclusion.
The patient chart tabs above allow access to all test results. Please click on one to begin the case study review. When you feel you have collected adequate information from the test results and library please proceed to the test.
TEST

← 30

Fig. 3



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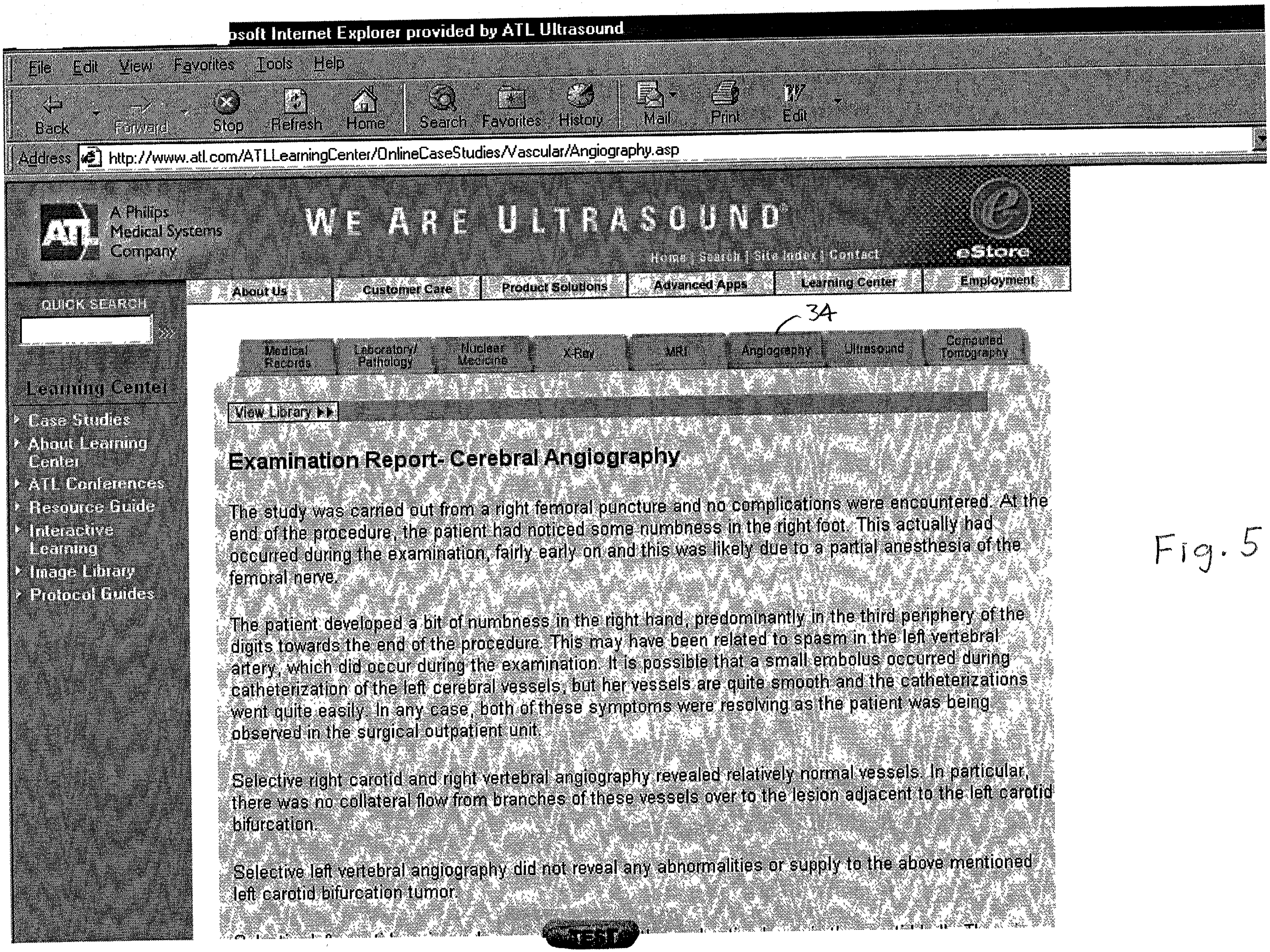
Clinical History: The patient is an obese female born in 1932. She quit smoking cigarettes in 1993 but did smoke for 45 pack years. She is currently taking medication to control hypertension, hyperlipidemia, diabetes mellitus, and the occasional angina attack. She has a strong family history of diabetes and atherosclerotic disease. The patient had a right common iliac artery transluminal dilatation in 1987, an appendectomy in 1942 and a previous problem with peptic ulcers in 1975.
The patient is asymptomatic, but has been experiencing some intermittent bilateral eye blurriness in the last month, possibly related to her diabetes. Blood pressure is 154/90 and no carotid bruits are present. The chest is clear and no abnormal abdominal palpations felt. Pulses for the carotid, radial, femoral and popliteal arteries are a 2+. The pedal pulses are weak with a grading of 1.
Exam Report: Considering the patient's strong family history of atherosclerotic disease and the patient's own risk factors such as hypertension, hyperlipidemia, diabetes, peripheral vascular disease, coronary artery disease, obesity and smoking, a carotid artery Doppler ultrasound has been ordered to assess the carotid arteries.
Medications: Acetylsalicylic Acid, Atenolol, Docusate Sodium, Zocor, Estrogen, Provera, Oxazepam, Kenral, Quinine Sulphate, Nitrodur Patch, Metformin and Glyburide.
TEST

Fig. 4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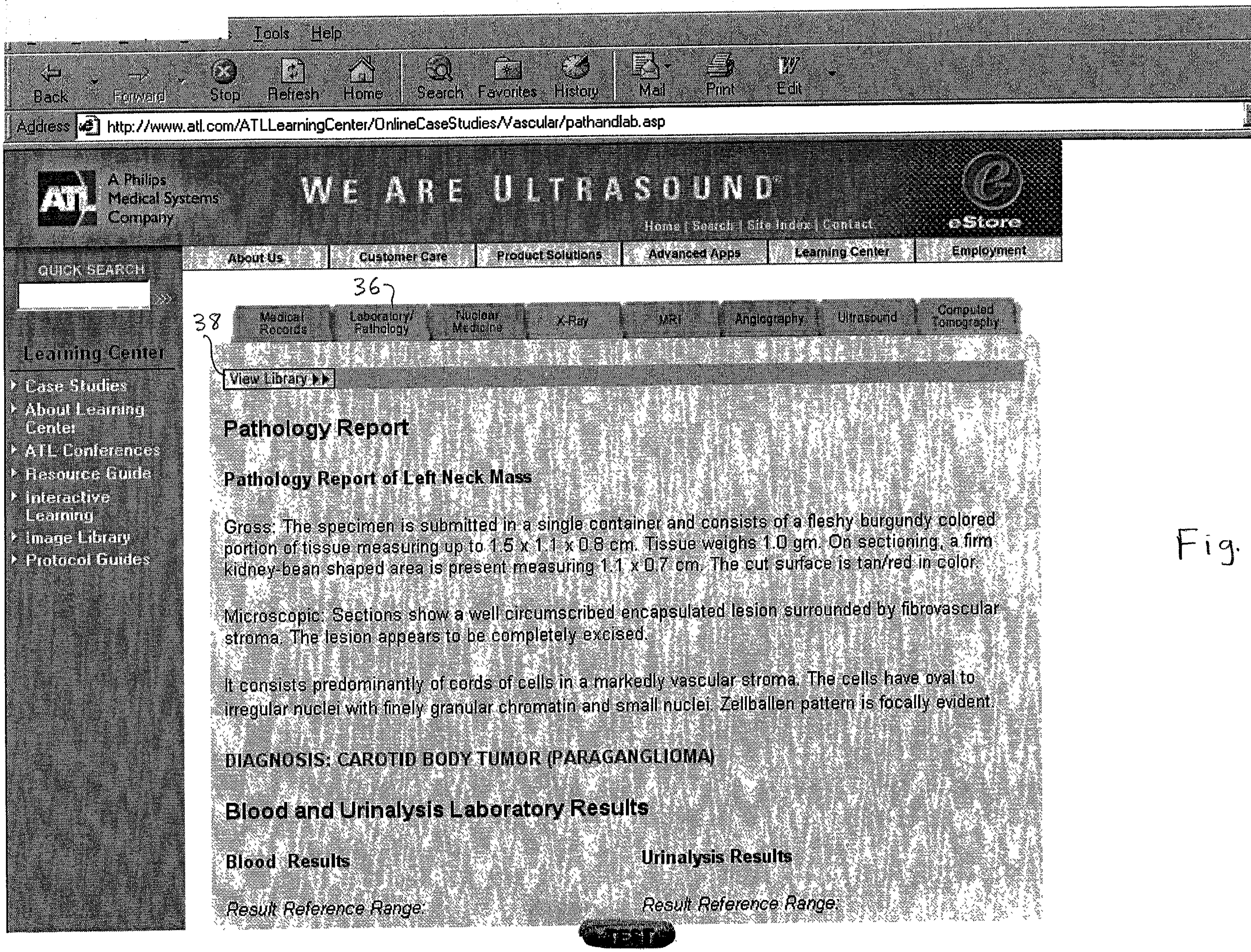
Examination Report- Cerebral Angiography
The study was carried out from a right femoral puncture and no complications were encountered. At the end of the procedure, the patient had noticed some numbness in the right foot. This actually had occurred during the examination, fairly early on and this was likely due to a partial anesthesia of the femoral nerve.
The patient developed a bit of numbness in the right hand, predominantly in the third periphery of the digits towards the end of the procedure. This may have been related to spasm in the left vertebral artery, which did occur during the examination. It is possible that a small embolus occurred during catheterization of the left cerebral vessels, but her vessels are quite smooth and the catheterizations went quite easily. In any case, both of these symptoms were resolving as the patient was being observed in the surgical outpatient unit.
Selective right carotid and right vertebral angiography revealed relatively normal vessels. In particular, there was no collateral flow from branches of these vessels over to the lesion adjacent to the left carotid bifurcation.
Selective left vertebral angiography did not reveal any abnormalities or supply to the above mentioned left carotid bifurcation tumor.
TEST

Fig. 5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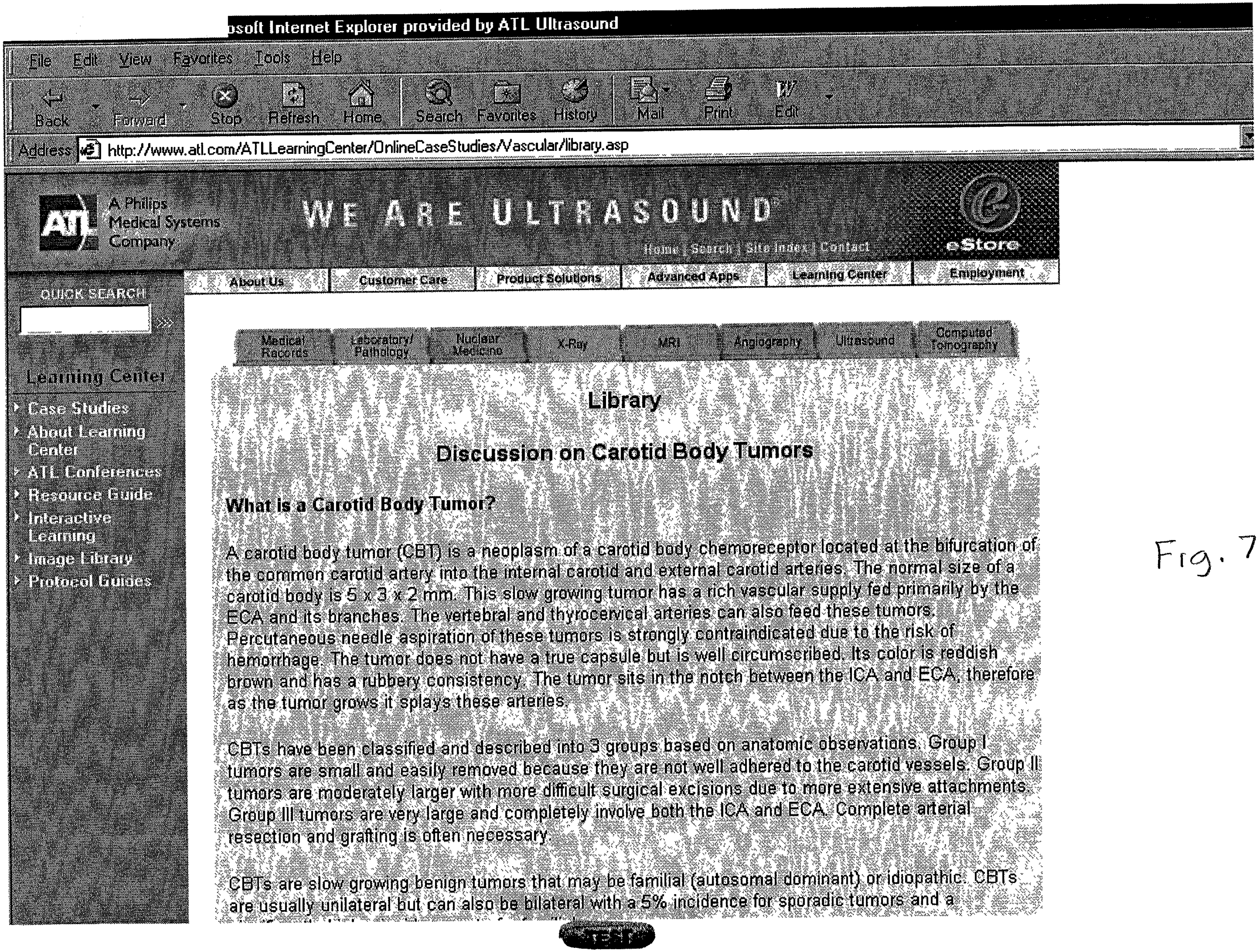
Pathology Report
Pathology Report of Left Neck Mass
Gross: The specimen is submitted in a single container and consists of a fleshy burgundy colored portion of tissue measuring up to 1.5 x 1.1 x 0.8 cm. Tissue weighs 1.0 gm. On sectioning, a firm kidney-bean shaped area is present measuring 1.1 x 0.7 cm. The cut surface is tan/red in color.
Microscopic: Sections show a well circumscribed encapsulated lesion surrounded by fibrovascular stroma. The lesion appears to be completely excised.
It consists predominantly of cords of cells in a markedly vascular stroma. The cells have oval to irregular nuclei with finely granular chromatin and small nuclei. Zellballen pattern is focally evident.
DIAGNOSIS: CAROTID BODY TUMOR (PARAGANGLIOMA)
Blood and Urinalysis Laboratory Results
Blood Results
Result Reference Range:
Urinalysis Results
Result Reference Range:
TEST

Fig. 6



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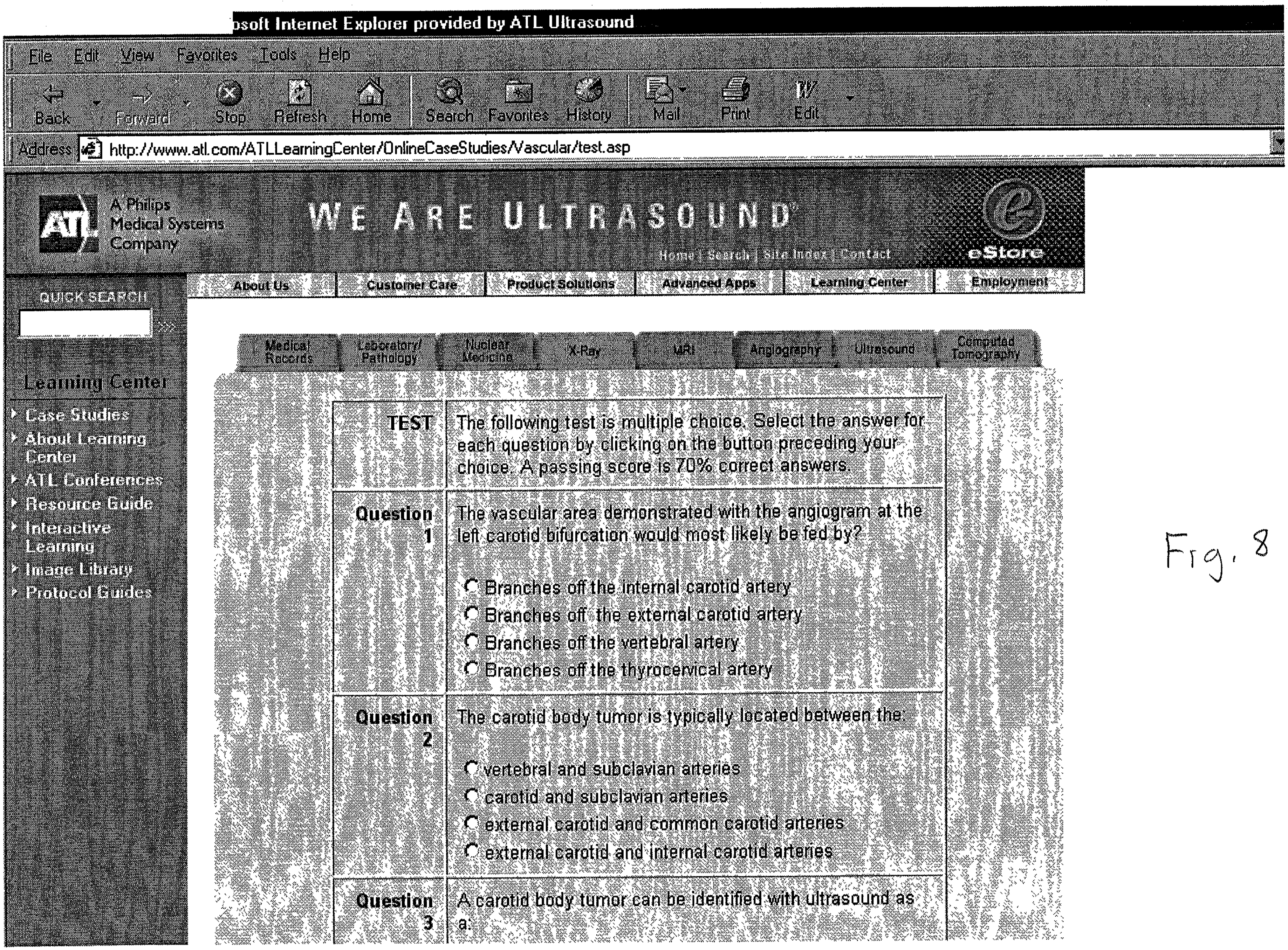
Discussion on Carotid Body Tumors
What is a Carotid Body Tumor?
A carotid body tumor (CBT) is a neoplasm of a carotid body chemoreceptor located at the bifurcation of the common carotid artery into the internal carotid and external carotid arteries. The normal size of a carotid body is 5 x 3 x 2 mm. This slow growing tumor has a rich vascular supply fed primarily by the ECA and its branches. The vertebral and thyrocervical arteries can also feed these tumors. Percutaneous needle aspiration of these tumors is strongly contraindicated due to the risk of hemorrhage. The tumor does not have a true capsule but is well circumscribed. Its color is reddish brown and has a rubbery consistency. The tumor sits in the notch between the ICA and ECA, therefore as the tumor grows it splays these arteries.
CBTs have been classified and described into 3 groups based on anatomic observations. Group I tumors are small and easily removed because they are not well adhered to the carotid vessels. Group II tumors are moderately larger with more difficult surgical excisions due to more extensive attachments. Group III tumors are very large and completely involve both the ICA and ECA. Complete arterial resection and grafting is often necessary.
CBTs are slow growing benign tumors that may be familial (autosomal dominant) or idiopathic. CBTs are usually unilateral but can also be bilateral with a 5% incidence for sporadic tumors and a

Fig. 7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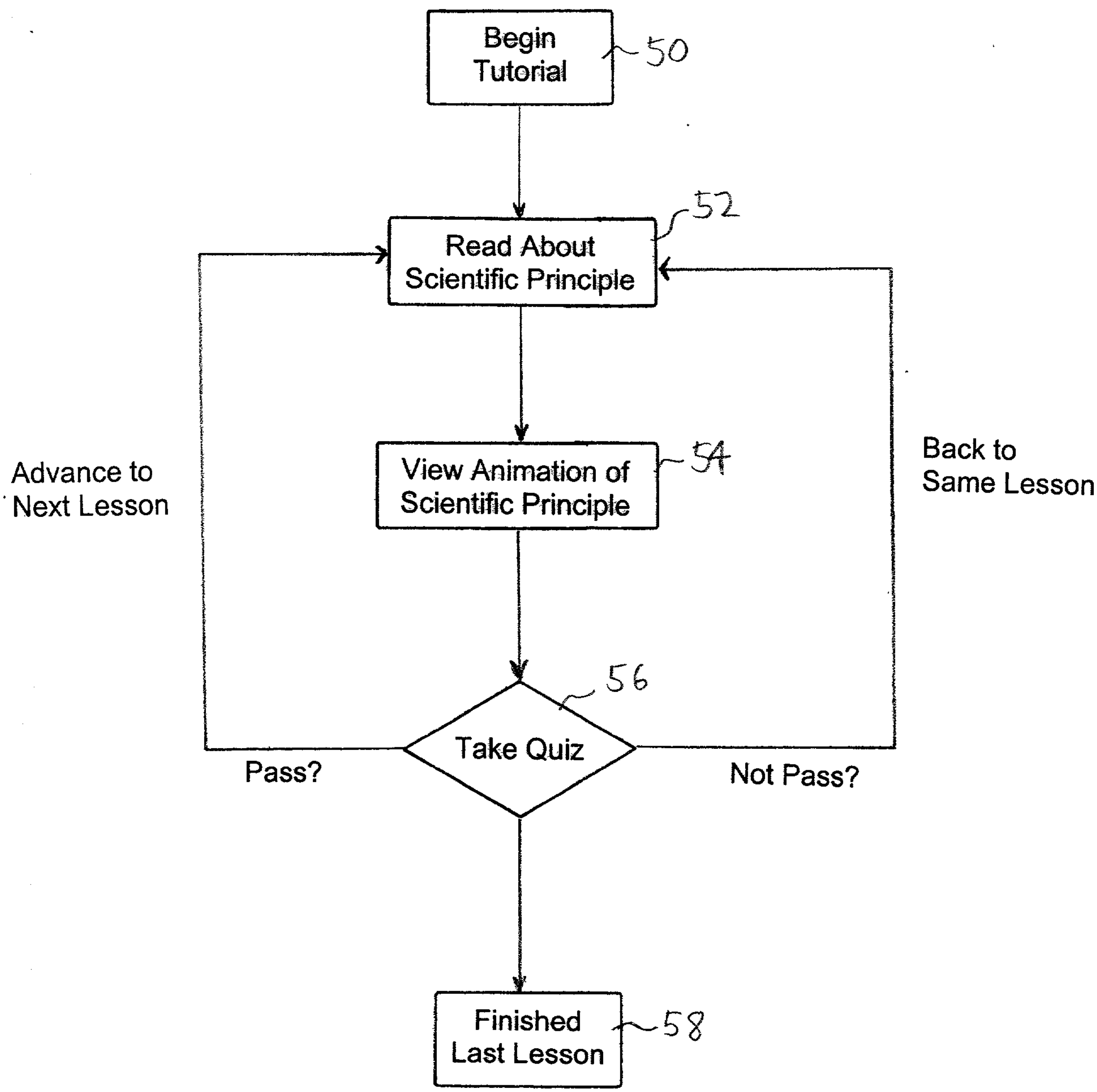
TEST
The following test is multiple choice. Select the answer for each question by clicking on the button preceding your choice. A passing score is 70% correct answers.
Question 1
The vascular area demonstrated with the angiogram at the left carotid bifurcation would most likely be fed by?
Branches off the internal carotid artery
Branches off the external carotid artery
Branches off the vertebral artery
Branches off the thyrocervical artery
Question 2
The carotid body tumor is typically located between the:
vertebral and subclavian arteries
carotid and subclavian arteries
external carotid and common carotid arteries
external carotid and internal carotid arteries
Question 3
A carotid body tumor can be identified with ultrasound as a:

Fig. 8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Read About Scientific Principle
52
View Animation of Scientific Principle
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Take Quiz
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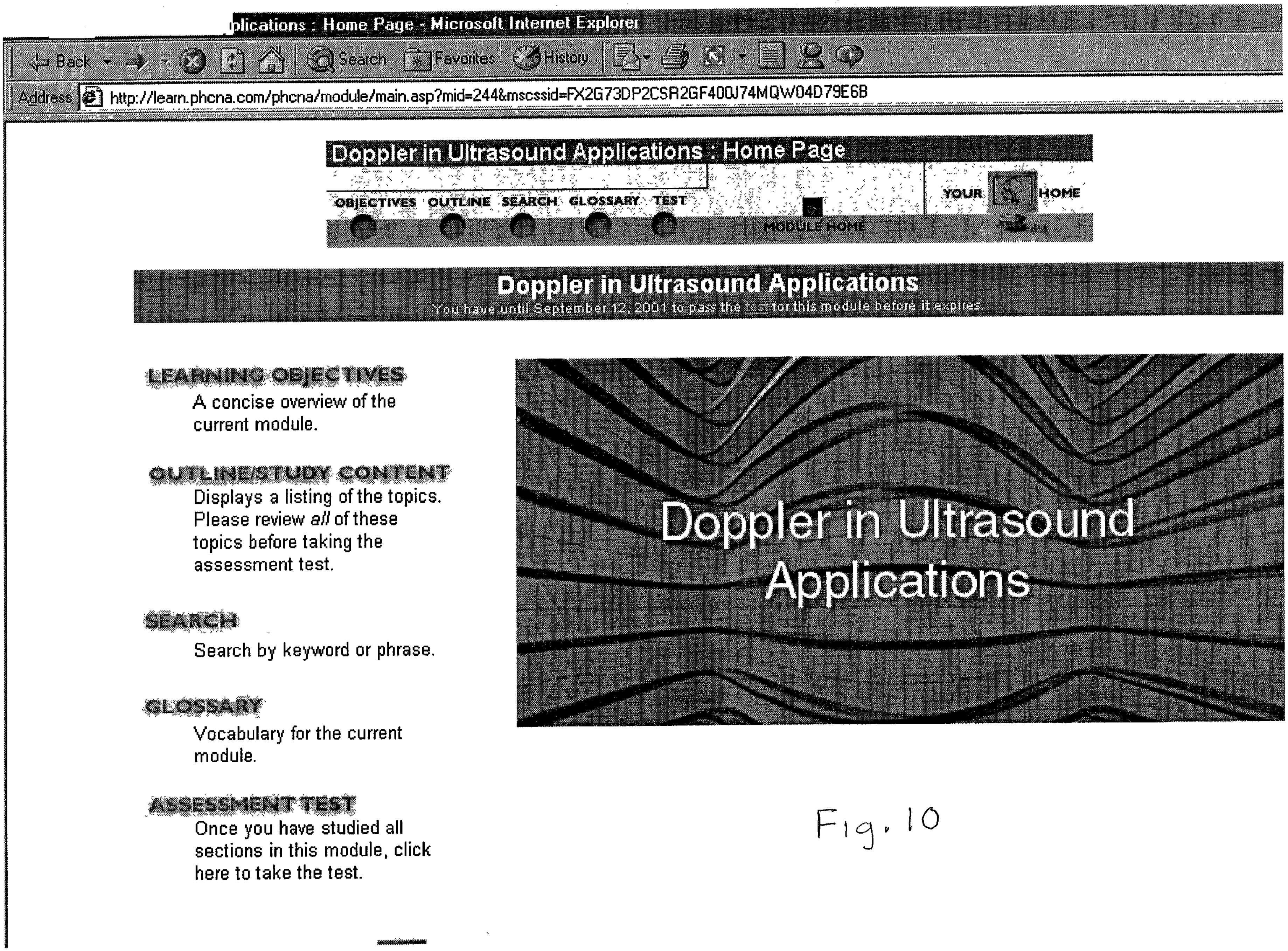
Finished Last Lesson
58
Advance to Next Lesson
Pass?
Back to Same Lesson
Not Pass?

Fig. 9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Doppler in Ultrasound Applications
You have until September 12, 2001 to pass the test for this module before it expires.
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A concise overview of the current module.
OUTLINE/STUDY CONTENT
Displays a listing of the topics. Please review all of these topics before taking the assessment test.
SEARCH
Search by keyword or phrase.
GLOSSARY
Vocabulary for the current module.
ASSESSMENT TEST
Once you have studied all sections in this module, click here to take the test.
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Fig. 10

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Doppler Effect

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Components of Doppler Equation

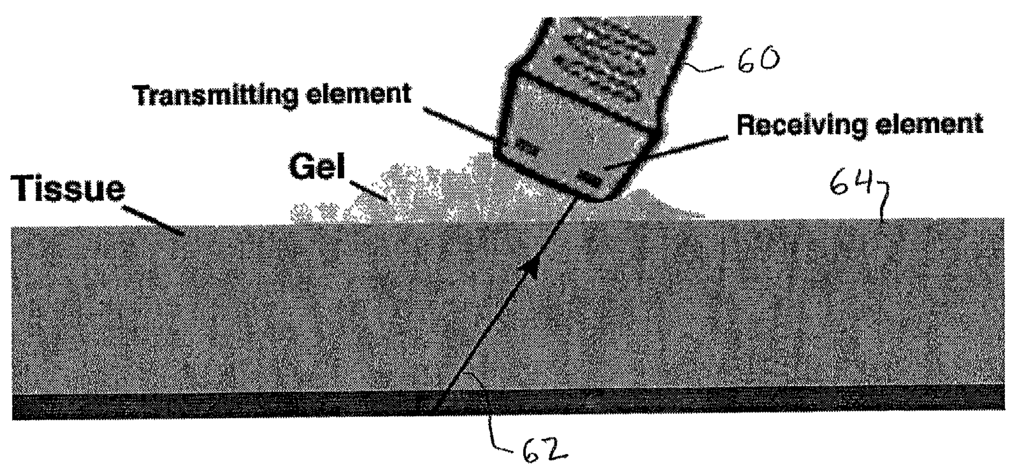
Doppler ultrasound transducers use two piezoelectric elements, one to transmit ultrasound **Ft** and one to listen for returning echoes from the moving blood cells **Fr**.

The **factor 2** is present to account for the fact that the Doppler effect actually occurs twice. The first Doppler effect occurs when the transducer is the stationary source of the sound wave and the moving blood cells are the receivers. The second Doppler effect occurs when ultrasound is reflected from the blood cells. The blood cells act as a moving source of sound waves and the transducer acts as a stationary receiver.

68

v = the velocity of the blood (what we are trying to determine)

Fig. 11



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Doppler Effect

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Pulsed Wave Doppler

Pulsed wave Doppler ultrasound uses a single piezoelectric crystal for both transmission and reception of sound waves. The system transmits short pulses of sound waves at regular intervals. It then waits for a specified time and only then receives signals from a certain depth. This is similar to pulse-echo imaging. Using this technique, the depth from which the signal originated can be calculated.

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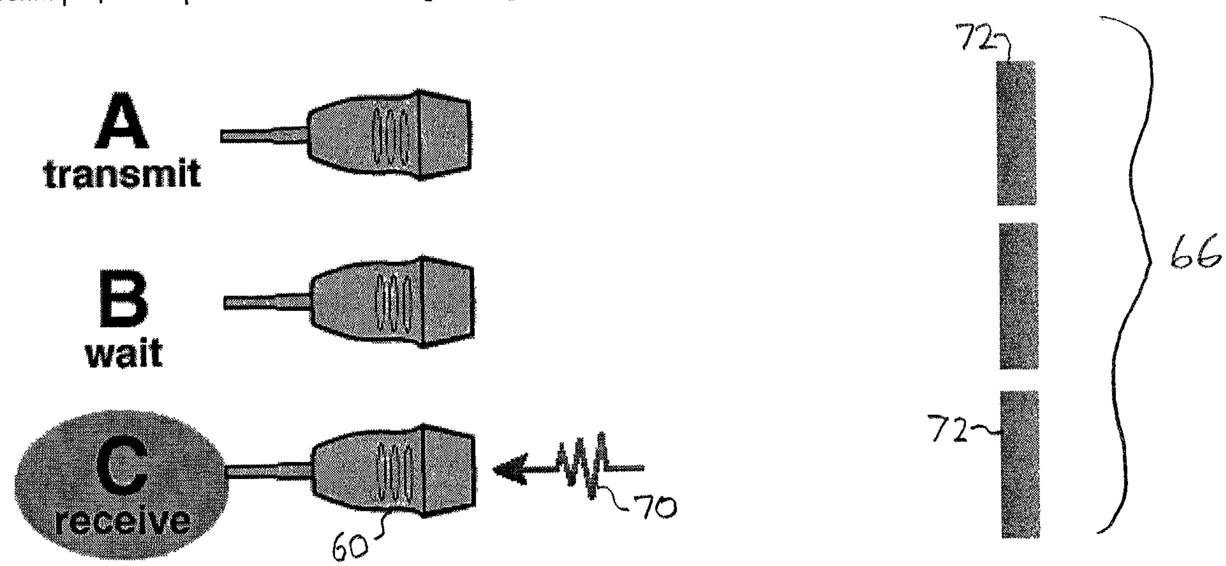

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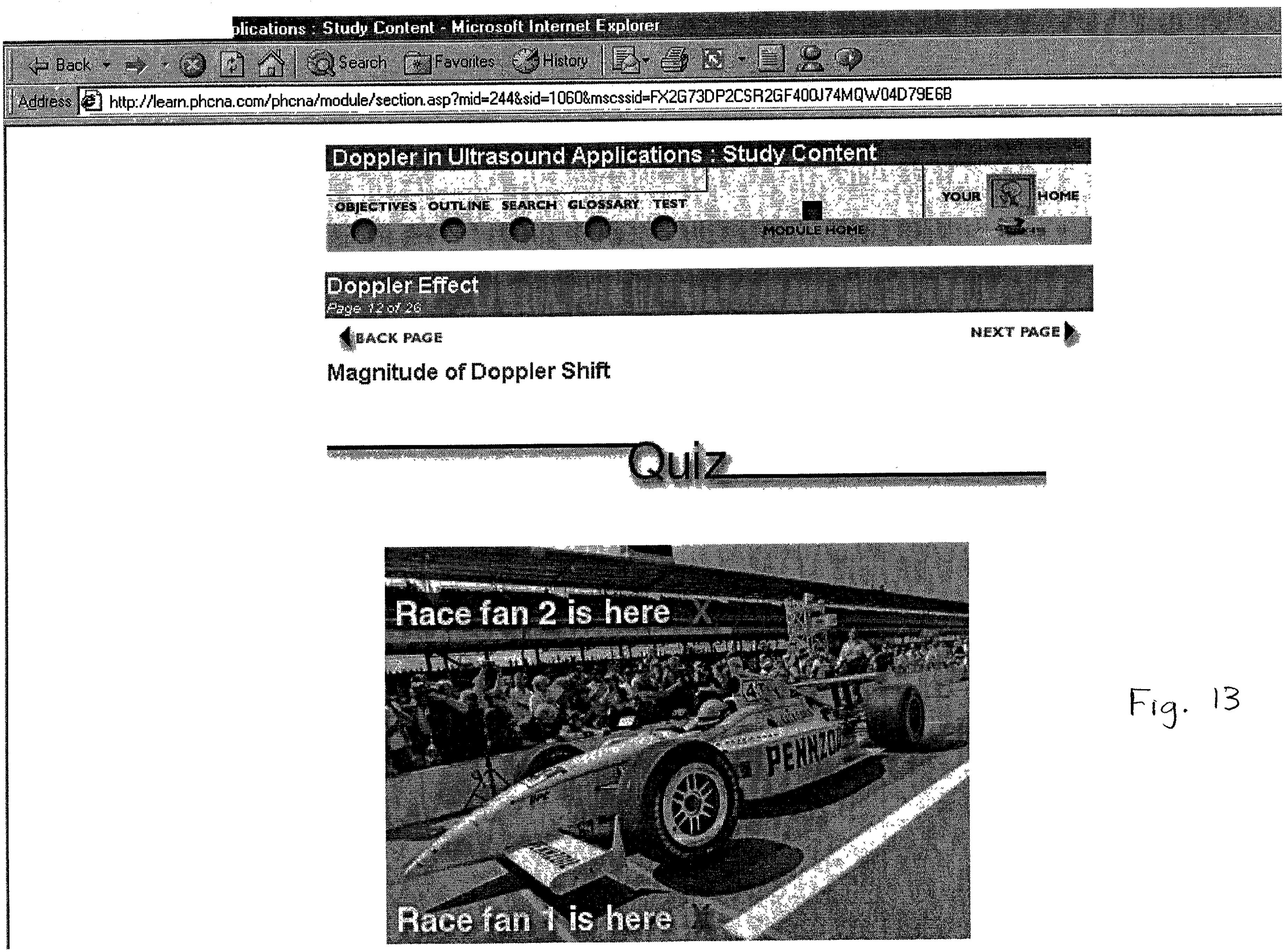
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Magnitude of Doppler Shift
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Fig. 13

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Doppler Ultrasound Signal Analysis and Optimization : Study Content

Analysis of Doppler Signal

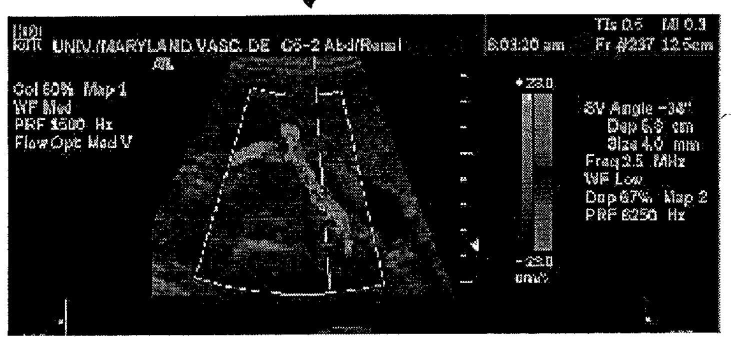
Maximum Velocity Measurements

The Doppler equation can be used in duplex imaging to convert frequencies into velocities. This is because the angle between the Doppler beam and the blood vessel can be estimated. Analysis of the components of the Doppler waveform shows that many velocities are displayed in the spectrum and these velocities vary with time, due to the cardiac cycle.

The value most commonly used for the measurement of velocity is peak systolic flow. This is the maximum velocity in the spectrum at peak systole. Maximum velocity can also be measured at end diastole. These velocity measurements represent the fastest moving blood flow in the center of the vessel and do not include the slower moving flow near the vessel wall.

Fig. 14

80



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